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FRIDAY, MAY 30, 1919

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FRIDAY, MAY 30, 1919

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THE LESSONS OF THE PANDEMIC

THE pandemic which has just swept round the earth has been without precedent. There have been more deadly epidemics, but they have been more circumscribed; there have been epidemics almost as widespread, but they have been less deadly. Floods, famines, earthquakes and volcanic eruptions have all written their stories in terms of human destruction almost too terrible for comprehension, yet never before has there been a catastrophe at once so sudden, so devastating and so universal.

The most astonishing thing about the pandemic was the complete mystery which surrounded it. Nobody seemed to know what the disease was, where it came from or how to stop it. Anxious minds are inquiring to-day whether another wave of it will come again.

The fact is that although influenza is one of the oldest known of the epidemic diseases, it is the least understood. Science, which by patient and painstaking labor has done so much to drive other plagues to the point of extinction has thus far stood powerless before it. There is doubt about the causative agent and the predisposing and aggravating factors. There has been a good deal of theorizing about these matters, and some good research, but no common agreement has been reached with respect to them.

The measures which were introduced for the control of the pandemic were based upon the slenderest of theories. It was assumed that the influenza could be stopped by the employment of methods which it was assumed would stop the other respiratory diseases. This double assumption proved to be a weak reed to lean upon. The respiratory diseases as a class are not under control. They constitute the most frequent cause of death, yet it is not known how they can be prevented.

Three main factors stand in the way of pre-

vention: First, public indifference. People do not appreciate the risks they run. The great complexity and range in severity of the respiratory infections confuse and hide the danger. The infections vary from the common cold to pneumonia. They are not all separate entities by any means. An attack which begins as a coryza or rhinitis may develop into a pharyngitis, tonsilitis, laryngitis, bronchitis or pneumonia. The gravity increases with the progress toward the lungs. The infection sometimes seems to begin in the chest, sometimes in the throat, sometimes in the head. It may stop where it started or pass through several phases. This is the story of the common cold. It is generally more discomforting than dangerous. Most people get well without skillful treatment, or indeed any great interference with business. No specific virus is known to produce it.

There is another group of diseases, a more unusual one, which is often at first confused with the foregoing. This includes the specific infections such as diphtheria, measles and scarlet fever. Influenza is in this class. The symptoms at the beginning may be identical with those of the common cold and the true nature of the disease escape notice until the patient shows unmistakable and alarming symptoms. By that time other persons may be infected.

The second factor which stands in the way of prevention is the personal character of the measures which must be employed. The enteric infections can be controlled by procedures of a general sort which impose no great restriction upon the conduct of the individual, but this is not true of the respiratory infections. The waste products of influenza containing the infective virus are not deposited in a vessel or sewerage system where they can be properly dealt with as in typhoid. The excreta of the nose and throat are projected into the air and allowed to pollute the hands, the food, the clothing and, in fact, the entire environment of the infected person. This is done unconsciously, invisibly, unsuspectingly. General methods directed against this kind of germ distribution must necessarily be of limited value.

It is an epidemiological point of great interest that the kind of preventive measures which must be taken in order to control the respiratory infections devolve upon the persons who are already infected, while those who are liable to contract the disease can do little to protect themselves. The burden is placed where it is not likely to be well carried. It does not lie in human nature for a man who thinks he has only a slight cold to shut himself up in rigid isolation as a means of protecting others on the bare chance that his cold may turn out to be a really dangerous infection.

Third, the highly infectious nature of the respiratory infections adds to the difficulty of their control. The period of incubation varies considerably; in some infections it may be as short as a day or two. And the disease may be transmissible before the patient himself is aware that he is attacked.

This list of the obstacles which stand in the way of controlling the respiratory diseases may fittingly be closed by remarking that healthy persons often carry about in their persons the germs of disease, thereby unconsciously acting as a continuing danger to themselves and a menace to others. It is not to be wondered at, therefore, that of all the things which were done to stop the spread of influenza, nothing seems to have had any material effect upon it.

This may all seem very discouraging but it need not depress anybody. The control of typhoid once seemed an impossible task. To rightly measure a difficulty is often the first step toward overcoming it.

What is said here of the influenza pandemic is put forward only as the writer's view at the present time. Nobody can now speak authoritatively upon this subject. When all the facts are brought together some of the ideas which are held to-day may be found to require modification. We are still too close to the event to fully measure it. Individual researches and the efforts of innumerable workers, must be reported and evaluated. The

mass of statistical data which has accumulated in cities, towns, camps and hospitals must be assorted, tabulated and studied before it will be possible to speak with anything like finality as to the efficacy of the measures of control employed.

Until this is done, it will be impossible to give the number of persons attacked, their age, sex, condition and race, the complications and sequelæ of the disease, much less the relations which these facts bear to the preventive measures. This work is now engaging the attention of many experts. Public health officers, skillful workers in bacteriology and pathology and able clinicians who have had opportunity to study the disease intensively are making their reports. It will be months and perhaps years before the records of all the scientific study connected with the pandemic are brought to a conclusion.

A good deal may confidently be expected of the work which has been done from so many angles and in so many places. How far the mysteries which have obscured the true nature of influenza for so many years will be cleared up must be left for time to show.

No disease is more difficult to study than pandemic influenza. It comes, it spreads, it vanishes with unexampled suddenness. It possesses such terrific energy that little time is afforded during its visitations in which to study it in a careful and painstaking manner. Both its total absence and its great prevalence stand in the way of its study.

But, it will be asked, is influenza entirely absent in the intervals between epidemics? Opinion is divided on this point. Some hold that pandemic influenza is a separate infection. Others think it is always with us. It does not ordinarily manifest such a fatal aspect as that recently seen, but many of the symptoms of the usual epidemic and the extraordinary pandemic influenza are the same. Perhaps the recent pandemic is best explained on the assumption that a particularly virulent type of the common infection was to blame.

All attempts at excluding influenza from a community seem to have failed. There is one and only one way to absolutely prevent it and that is by establishing absolute isolation. It is necessary to shut off those who are capable of giving off the virus from those who are capable of being infected, or vice versa. This is a very difficult procedure. First, it is difficult because it is impossible to discover all the virus producers. Second, it is difficult because it is impossible to know who are and who are not immune. Complete isolation is not feasible for entire cities nor for parts of cities, nor for individuals in cities. It is feasible for some small towns and villages, and some have tried it with success. The fact that in many instances the attack has been merely postponed by no means invalidates the principle.

It is natural to suppose that a phenomenon of such general nature as the influenza pandemic has had an equally general cause and the only cause which most people can think of as general enough to give rise to a world pandemic is one which possesses an atmospheric or terrestrial character. This is a very old conception and one which has survived all others so far as the general public is concerned. In one of its forms it is known as Sydenham's theory of epidemic constitution. In spite of the repeated statement that this theory has been discredited, there are many well-informed persons who believe as Sydenham did that there are general conditions beyond our knowledge which help to cause disease to assume a different aspect and prevalence in some years and at some seasons than at others.

As late as the pandemic of 1889–90 it was thought by many that the cause of the influenza outbreak was in some way connected with world conditions and quite independent of human intercourse. To-day there are some who think that the extraordinarily cold winter of 1917–18 followed by the hot summer was largely responsible for the recent pandemic. Others believe that the great war precipitated the plague. Not a few think that the infection was spontaneously developed in many places at about the same time. The arguments which have been made in support of

these suppositions are often ingenuous if not convincing. Unfortunately, they seldom stand the test of scientific analysis.

The weight of evidence now available indicates that the immediate cause of the great pandemic of 1918 was an infective virus which passed from person to person until it had spread all over the world. The method of spread is believed to have been the same as in other respiratory infections. The reasons for the belief that it was transmitted in this manner lies chiefly in the fact that the pandemic spread rapidly, and no more so, than people traveled from point to point.

Nobody so far has positively shown what the virus is, nor how it leaves or enters the body, nor at what period in the disease it may be transmitted to others. Some hold that the Pfeiffer bacillus is the causative agent, others believe that there is a filterable virus which acts independently or in conjunction with the Pfeiffer bacillus. Nearly all agree that the influenza and pneumonia were independent diseases and that the high fatality was due to a very remarkable reduction of resistance to the pneumonia brought about by the influenza. Being of the respiratory type, it is believed that the virus leaves the body by way of the nose and mouth. It is supposed to enter the body by way of the nose, mouth or eyes.

But, it may be asked, if the influenza and the Pfeiffer bacillus are always with us, why should the disease suddenly become so different from its ordinary type in respect to severity, infectivity and complications? Nobody has answered these questions.

There are various ways of replying to them. One is to assume that the infective poison was brought into civilized countries from some distant point where it originated. Another is to suppose that it developed locally. It is not possible to follow these theories through all their details here. The arguments are not convincing by any means. Certainly a complete explanation of the pandemic requires a demonstration of how the disease developed wherever that development took place.

The development of the disease was undoubtedly a complicated biological phenomenon. A virus was produced which was capable of overcoming the resistance of a large proportion of those who were exposed to it. Reductions in virulence are familiar occurrences in connection with infective poisons. Controlled attenuations have been at the foundation of a great deal of the best work in immunology since the time of Pasteur. Increases are less often observed, but it is a well established fact that a virus which has practically lost its pathogenic properties can be exalted to a high state of virulence by inoculating it into susceptible animals. The spontaneous recrudescences of virulent disease in epidemics which sometimes appear to have originated in mild epidemic infections suggest the same process.

Reasoning by analogy it would appear not unlikely that an influenza virus which existed somewhere, perhaps among persons who had become accustomed to it and had consequently gained a toleration to it, was introduced among others to whom it was a stranger and who were consequently particularly susceptible to it. This would naturally result in an outburst which might attain pandemic proportions.

The pandemic has shown among other things how widely and how quickly respiratory infections may travel. It has shown what an enormous interchange of germs takes place in the respiratory apparatus of those who live in cities and towns and villages. It is disquieting to find how readily and frequently the bacterial products of the sick gain entrance into the noses and mouths of other persons, but the facts must not be hidden if to acknowledge them will do any good.

The pandemic calls attention not only to the fact that there is an interchange of mouth germs wherever people meet, but it illustrates how frequently respiratory infections may occur to which little or no attention is given. Some people think that pandemics of colds occur from time to time which are almost as universal as was the recent influenza. Their pandemic character is not suspected because

they are so mild. A pandemic of influenza swept over the United States five months before the fatal wave but it attracted notice only in a few places.

The frequent presence of epidemics of colds affords the groundwork upon which other respiratory diseases should be studied. It has been well said by Sir Arthur Newsholme, Medical Officer of Health to the Local Government Board of England, that until the common respiratory infections are studied and controlled, it will be impossible to understand and manage influenza. With this opinion the present writer heartily agrees. The way to study influenza is to study the common cold. The place to study the common cold is a village or other circumscribed environment. The time to study it is now.

The great lesson of the pandemic is to call attention to the prevalence of respiratory diseases in ordinary times, to the indifference with which they are ordinarily regarded and to our present inability to protect ourselves against them. They are not amenable to control through sanitary works as are typhoid, malaria and so many other diseases. They must be controlled by administrative procedures, and by the exercise of appropriate measures of self protection.

Will there be another visitation? Nobody can positively answer this question. Influenza commonly sweeps in more than one wave over a country. America experienced an unmistakable, but mild, wave before the great one of September and October and since then there have been local disturbances corresponding to fresh outbreaks in many places. In England a new and alarming prevalence has been reported. It would not be surprising if there should be another pandemic in the United States.

The steps which should be taken to suppress the disease if it breaks out afresh are such as seem best for the maintenance of general health and protection from respiratory infections as a class. If doubt arises as to the probable efficacy of measures which seem so lacking in specificity it must be remembered that it is better for the public morale to be doing something than nothing and the general health will not suffer for the additional care which is given it.

First as to the things which it is desirable not to do. It is not desirable to close theaters, churches and schools unless public opinion emphatically demands it. It is not desirable to make the general wearing of masks compulsory. Patients should not be masked except when traveling from one point to another —they need air. Suspects should wear masks until their cases are positively diagnosed. Influenza patients should be kept separate from other patients. A case of influenza should be dealt with as though it was as contagious as a case of small-pox: there is danger in the presence of the sick, in his eating utensils, in his clothes and in the air into which he coughs and sneezes, if indeed these respiratory symptoms are present. He is to be regarded as much more seriously ill than his visible symptoms perhaps indicate.

It is worth while to give more attention to the avoidance of unnecessary personal risks and to the promotion of better personal health. Books have been written on the subject. The writer's idea of the most essential things to remember are embodied in the following twelve condensed rules which were prepared in September, recommended by the Surgeon-General of the Army and published by order of the Secretary of War to be given all possible publicity:

1. Avoid needless crowding—influenza is a crowd disease.
2. Smother your coughs and sneezes—others do not want the germs which you would throw away.
3. Your nose, not your mouth was made to breathe through—get the habit.
4. Remember the three C's—a clean mouth, clean skin, and clean clothes.
5. Try to keep cool when you walk and warm when you ride and sleep.
6. Open the windows—always at home at night; at the office when practicable.
7. Food will win the war if you give it a chance—help by choosing and chewing your food well.

8. Your fate may be in your own hands—wash your hands before eating.

9. Don't let the waste products of digestion accumulate—drink a glass or two of water on getting up.

10 Don't use a napkin, towel, spoon, fork, glass or cup which has been used by another person and not washed.

11. Avoid tight clothes, tight shoes, tight gloves—seek to make nature your ally not your prisoner.

12. When the air is pure breathe all of it you can—breathe deeply.

George A. Soper
Sanitary Corps,
U. S. A.

THE FREAS SYSTEM

Professor Thomas B. Freas, of the department of chemistry of Columbia University, has devised a scheme for the handling of apparatus and supplies that is not only novel and capable of indefinite expansion and adaptability to any chemical laboratory, but takes out of the hands of the instructional staff all handling of students' apparatus and chemicals.

The object of the Freas system is fourfold. First, to save the student's time by giving him all the chemicals and apparatus he needs at his bench, second, to insure pure and clean chemicals, third, to save of chemicals by giving the student just the amount needed, and doing away with the wasteful and sloppy side shelf reagents bottle, and fourth, to relieve the instructor of those details, and thus to enable him to devote his entire time to teaching and research.

Professor Freas has been too busy to publish an account of his scheme, and his extreme modesty prevents him undertaking the task, had he the time. As an interested outsider who has watched very closely how it works, at Columbia, I am perhaps better qualified than even he to speak of what seems to me the best scheme in America to handle this difficult problem. This scheme has been in operation in all divisions of chemistry at Columbia for the past seven years, and has given an ever increasing satisfaction to all concerned.

Many instructors spend most of their time handling supplies, although they are hired to teach, but they are not allowed to do so by the short-sighted and expensive policy of many institutions, which compel them to do work which a moderately paid employee could do just as well. One full professor of industrial chemistry of my acquaintance spends a greater part of his time supplying his students with chemicals, when an organized system could do it immensely better, leaving him free to devote his time to instruction.

In a modern chemical laboratory, and especially so in a large one, the problems are so numerous and so complex, that modern business methods require a sharp line to be drawn between the pedagogic and administrative affairs from those of up-keep maintenance, purchase, and handling of supplies. This eventually demands that the head of the department divest himself of all duties pertaining to the physical side of the laboratory, and turn that work over to the carefully selected and specially trained curator of supplies. If the administrative head has chosen wisely, he is not only relieved of an enormous burden, thus freeing himself for the instructional side of his profession, but the laboratory students and instructional staff gain by having this work done by an expert.

The success of the Freas system depends upon having some one man in the department, who is interested, selected to be the curator of supplies. He must have recognition, both in rank and salary, to attract a man of character, ability and training in laboratory needs. His time should be free for general guidance of others, by having several competent assistants, one in the office, one to handle chemicals and superintend the bottling, and one to handle all apparatus. In a small chemical department some of these divisions could be combined. The man or preferably a woman, in charge of the office, attends to all student accounts, keeps the books, takes dictation, and if the work is excessive has enough help to properly handle the work. The salary is about $75 to $100 a month, with two weeks' vacation, and one week sick leave during the year. This

applies to all the assistants in the stock system.

The man who handles the chemicals must have a steady working force, determined by the demands of the department. He is held responsible for the care and storage of all chemicals, and must notify the office of any needs. His main duty is, however, the bottling of liquid and solid reagents for student kits in ample time to have them ready at the beginning of each term. In a chemical department of 700 students this is an enormous task, when one course may require 140 different bottles per man. But with a good man in charge of several boys, and in rush times, extra student help, those chemicals can be put up, gathered together, in sets, and got ready for the student rush on the first day of the term. The man in charge need not receive over from $90 to $125 per month, and the boys over $10 a week. Student help may be used at an hourly remuneration, differing with the locality and the school.

The cost of this entire work is very small, when compared with the expense when this same work is done in the old way by a $3,000 a year man. The apparatus can be well handled by any capable woman with one or more assistants.

On checking out day the instructor assigns a student to a laboratory bench. The students take that slip to the office to see that all fees have been paid, and deposit for excess chemicals and breakage have been made. At the supply window he now receives and signs for his entire kit of chemicals and apparatus for one term. That material he arranges in his desk according to a plan which is given him. He locks his desk with his own padlock, which he can get from the stock-room if he wishes to do so, for a small sum. He now has his own chemicals and apparatus in his own individual locker, protected by his own padlock, to which he only has the key. The student is now solely responsible for breakage and loss, and his excess chemicals and breakage deposit protects the department against loss either from accident or by the student leaving the institution. Should he need extra chemicals or supplies, he can easily obtain these at the supply window by signing for the same. At Columbia the student receives as free allowance, the average chemicals needed for his particular course, and pays for excess chemicals, as being a loss due to his carelessness.

Many benefits arise from this arrangement, viz., individual responsibility for care of apparatus and chemicals; a much reduced consumption of chemicals, because the amount given is just sufficient for the experiment, plus a slight margin for unavoidable waste; all unnecessary movement is eliminated, as the student seldom has to leave his own bench, providing the laboratory is modern, and has at the benches individual student hoods; a doubling of the assigned amount of laboratory work, in the same time, due to a reduction of lost motion, and moving about the room, as exists under the old fashioned side reagent scheme, and finally, a relieving of the instructor of every duty, but that of teaching, which is probably the most important of all. A set of weights and a rough hand balance as a part of the kit avoids having common weights and balances, and the necessary walking and waiting one's turn to weigh under the old plan. The laboratory has no common property of any kind where theft, contamination, or injury is possible. The only exception is in the balance room, where two or more men are assigned to a quantitative balance, which is locked, and only assigned men have keys. Here responsibility can easily be fixed among a very few students.

Such a plan can only be possible when the curator of supplies has the sympathetic cooperation and support of the administrative head of the department. Many well meaning administrators of the old school pay little attention to the application of modern business methods to running a laboratory. Efficiency and expert ideas, when applied to that job are frowned on. It is the author's opinion that these men can not be regarded as progressive administrators, and it is his conviction that the department will go on in the same old way as back numbers, till some one

wakes up, or those who obstruct progress retire. There is no question, but that the chemical department which undertakes to run its laboratory on a strict business basis, will not only give their students more and better service for the same money, but will turn out better trained men than the laboratory with less up-to-date methods.

The College of the City of New York has partly adopted the Freas System, with such satisfactory results that we have almost doubled the amount of laboratory work given to the students per afternoon. The author feels that we should go the whole way and reap the full reward in more efficient work on the part of student and instructor. Starting is the big thing, but when once started, the plan will grow by its own intrinsic merits.

For a number of years past, the summer session of Columbia University has offered a course in laboratory organization and management, where the ideas I have here discussed have been carefully criticized by the students taking the course, mostly men and women of experience along the same line in other institutions.

Further details of this scheme will appear from time to time.

W. L. Estabrooke
Department of Chemistry,
College of the City of New York

ORGANIZATION MEETING OF THE AMERICAN SECTION OF THE PROPOSED INTERNATIONAL ASTRONOMICAL UNION

At the organizing meeting of the International Research Council held in Paris in November, 1918, it was decided to establish an International Astronomical Union, to continue and extend the work formerly conducted by such international astronomical organizations as the committee of the Carte du Ciel, the International Union for Cooperation in Solar Research, and similar bodies less formally constituted which dealt with various questions relating to astronomy and its applications. The International Research Council adopted a resolution requesting the National Academy of Sciences, or the corresponding organization in each of the countries represented, to take the initiative in organizing the section to represent that country in the International Astronomical Union. The tentative plan of organization of the American Section of the Astronomical Union, as approved by the president of the National Academy of Sciences, involved the representation of the various interests concerned as given below.

Upon the call of Dr. George E. Hale, acting for the National Academy of Sciences, the organization meeting for the American Section of the proposed Astronomical Union was held in the office of the National Research Council, Washington, D. C., March 8, 1919. The delegates who had been appointed by the presidents of the respective societies, or by the government, were as follows:

National Academy of Sciences—5.

H. D. Curtis acting for W. W. Campbell, G. E. Hale, A. A. Michelson, F. R. Moulton, Frank Schlesinger.

American Astronomical Society—10.

C. G. Abbot, S. I. Bailey, E. W. Brown, E. B. Frost, A. O. Leuschner, S. A. Mitchell, W. J. Humphreys, H. N. Russell, Joel Stebbins (absent, J. F. Hayford).

American Mathematical Society—3.

Frank Morley (two others to be appointed).

American Physical Society—3.

Henry Crew (absent, J. S. Ames, Theodore Lyman).

U. S. Naval Observatory—1.

J. A. Hoogewerff, accompanied by W. S. Eichelberger, Asaph Hall, F. B. Littell.

U. S. Coast Survey—1.

William Bowie.

The meeting organized by appointing Mr. Hale as chairman and Mr. Stebbins secretary. There followed a general discussion of the present international situation of science, and it was agreed that the union should take the place of previous international bodies in astronomy.

It was voted that the organization of the section should be considered temporary until

after the proposed conference in Paris in July, 1919.

The section voted that the chair appoint a committee on committees, to act temporarily as an executive committee, which should consider the general matter of business, appoint all committees, and add six additional members to the section. Appointed: W. W. Campbell, chairman; C. G. Abbot, E. W. Brown, Frank Schlesinger, Joel Stebbins, secretary. The committee added the following to the membership of the section: W. S. Adams, R. G. Aitken, E. E. Barnard, L. A. Bauer, Benjamin Boss, W. S. Eichelberger, W. J. Hussey, V. M. Slipher.

In regard to membership of enemy nations in the union, the section voted to adopt as representing the sentiments of the meeting the declaration of the Interallied Conference on International Scientific Relations, held at the Royal Society in London on October 9 to 11, 1918.

In regard to the admission of neutral nations to the union, the section voted that it be the sense of the meeting that nations which had been neutral in the war should be admitted into the International Astronomical Union on the conclusion of peace.

Mr. Schlesinger outlined the kind of astronomical work that requires international cooperation:

1. Work too extensive to be undertaken except by international cooperation; the Carte du Ciel, for example, or the plan of selected areas.

2. Undertakings in which there is a geographical necessity for international cooperation. Variation of latitude, longitudes, variable stars, continuous observation of solar phenomena, etc.

3. Matters of convention. Uniformity of nomenclature, notation and units. Examples, unit for stellar distances (four now in use), classification of spectra, use of probable or mean error or of average deviation, notation for celestial mechanics, notation for the reduction of photographic plates, etc.

4. The avoidance of duplication. Calculations for the national almanacs and for special ephemerides, such as comets, asteroids and variable stars. Astronomical abstracts, and news of new comets, variable stars, novæ, asteroids and the like.

The section discussed the various fields in astronomy in which committees should be formed to make report at another meeting of the section, which would give instructions to the delegates to the proposed Paris conference. The following committees were authorized by the section. The executive committee later made the appointments:

Committee on the Variation of Latitude: E. B. Littell, chairman; A. O. Leuschner, Frank Schlesinger. It was voted to ask the American Section of the International Geophysical Union to appoint a similar committee to confer and make a joint recommendation on the organization and method of handling the variation of latitude.

Committee on Standards of Wave-Length: Henry Crew, chairman; H. D. Babcock, Keivin Burns, W. W. Campbell, C. E. St. John.

Committee on Solar Rotation: C. E. St. John, chairman; W. S. Adams, Frank Schlesinger.

Committee on Eclipses: S. A. Mitchell, chairman; E. E. Barnard, H. D. Curtis.

Committee on Stellar Classification: H. N. Russell, chairman; Miss Annie J. Cannon, R. H. Curtiss.

Committee on Asteroids and Comets: A. O. Leuschner, chairman; E. W. Brown, G. H. Peters.

Committee on Almanacs: W. S. Eichelberger, chairman; E. W. Brown, R. H. Tucker.

Committee on Radial Velocities: W. W. Campbell, chairman; W. S. Adams, J. S. Plaskett.

Committee on Double Stars: R. G. Aitken, chairman; Eric Doolittle, W. J. Hussey.

Committee on Notation, Units and Economy of Publication: W. J. Humphreys, chairman; E. B. Frost, A. O. Leuschner.

Committee on Meridian Astronomy: Benjamin Boss, chairman; F. B. Littell, Frank Schlesinger.

Committee on Abstracts and Bibliographies: F. E. Fowle, chairman; H. D. Curtis, G. S. Fulcher.

Committee on Research Surveys: G. E. Hale, chairman; F. R. Moulton, Harlow Shapley.

Committee on Stellar Photometry: F. H. Seares, chairman; S. I. Bailey, F. C. Jordan, J. A. Parkhurst, Joel Stebbins.

Committee on Wireless Determination of Longitude: J. A. Hoogewerff, chairman; W. W. Campbell, J. J. Carty. This committee was requested to

study the feasibility of determinations of longitude by wireless at widely distributed stations, and report on what seems to be the proper time and method for such undertakings.

Committee on Solar Radiation: C. G. Abbott was asked to prepare a report on solar radiation.

Committee on the Spectroheliograph: The Mount Wilson Solar Observatory was asked to prepare a report on work with the spectroheliograph.

Committee on Reform of the Calendar: R. T. Crawford, chairman; W. W. Campbell, Harold Jacoby.

The question of delegates to the Paris meeting was left to the executive committee with power.

It was voted that the section offer to act in astronomical matters as the agent of the Division of Physical Sciences of the National Research Council.

Various other items of organization and scientific interest were discussed by the section at the morning and afternoon sessions, and in the evening, without formal action.

Joel Stebbins,
Secretary

SCIENTIFIC EVENTS

WAR RESEARCHES AT ST. ANDREWS UNIVERSITY

The University of St. Andrews, as reported by the London *Times*, has an interesting record of scientific service during the war, notwithstanding the fact that nearly all the men students and members of the staff of military age joined the fighting forces.

One of the early difficulties encountered by the British Admiralty and War Office was the provision of the scarce and costly kinds of sugar used in bacteriological work, which before the war had been prepared in Germany. The St. Andrews Laboratory was able to provide supplies for the British and Allied governments. In some cases the raw material itself was not to be had and new synthetic methods were devised for its production. The laboratory took part in preparing novocain and the corresponding intermediates, new processes being developed which have been adopted successfully on a manufacturing scale. Other synthetic drugs were also produced.

Professor Irvine, the director of the laboratories, acted as chemical adviser to the Department of Propellant Supplies, and for two years and a half was responsible for investigations relating to the manufacture of the materials needed for making cordite. During the last eighteen months of the war the laboratory carried on researches into chemical shellfillings.

The general work of the university was restricted during the war. But, owing to the large number of women students, the courses qualifying for useful professions were kept up with the help of senior officials, who undertook additional duties, and of extra women teachers.

Without knowing what financial help will be forthcoming from the government or the Carnegie Trust, it is impossible to say anything very definite on the developments which will take place in the new conditions created by the war. The endowments of St. Andrews leave little margin for expansion. But in general the policy of the university authorities is rather to increase the facilities for higher study and research in existing departments than to dissipate energies over a wider range of subjects. The training of graduates in research methods has been a special feature of the university for many years. It is hoped to extend the research laboratories and to enable research graduates in chemistry to combine with a training based on fundamental scientific principles a better knowledge of the necessities and methods of manufacture. A start has indeed already been made in this direction.

The university has felt justified in providing a Ph.D. degree open to graduates of British, colonial and foreign universities on terms similar to those which govern graduation in German universities. Students who wish to enter the university at a later age than usual are to be encouraged by the removal of the bar which they have hitherto met with in the preliminary examinations. In pure science the way is opened to more intensive specialization in the study for honor degrees. Syste-

matic courses of instruction in commerce have been instituted, leading to graduation.

The number of graduates and students who served with the forces during the war was about 800. Of these 96 have been killed or reported missing.

THE DEPARTMENT OF BACTERIOLOGY AND PUBLIC HEALTH IN YALE UNIVERSITY

AN outline of the work planned by the department of bacteriology and public health of Yale University, is given by Professor C.-E. A. Winslow in a recent number of the *Yale Alumni Weekly*. After consultation with the leading eastern universities a comprehensive program has been prepared leading to the Certificate in Public Health and the Doctorate in Public Health as well as to the Doctorate in Philosophy.

The Certificate in Public Health, which is to be conferred for one year of post-graduate study, is designed for two classes of students. On the one hand, young men and women who are just graduating from a college or technical school and desire to enter the field of public health, will be given a broad training in bacteriology, sanitation, health organization and vital statistics which will fit them for positions in health department laboratories and statistical bureaus, in bureaus of child hygiene or in other state and municipal departments. Outside of this district field of public service, experience has shown that those who hold the Certificate in Public Health may frequently find attractive positions as health executives, or as secretaries and field agents of various private organizations such as anti-tuberculosis societies, housing associations and the like.

A second class of students of maturer years for whom provision must be made, includes persons who have already specialized in some field related to public health, in medicine, for example, or sociology, or psychology or sanitary engineering, and desire to apply their special knowledge in the campaign for public health. The course for the Certificate in Public Health, with the freedom of election permitted to such mature students, is well adapted to give them a grasp of the general tendencies of the public health campaign and the special training they need in order to apply their knowledge in this field.

For students who desire to specialize in greater detail in certain of the various lines discussed above, opportunities will be offered to pursue a course of study of three years leading to the degree of Doctor of Philosophy, with opportunities for major specialization in problems of sanitation, epidemiology and industrial hygiene (with Professor Winslow); in public health bacteriology (with Professor Rettger); in the hygiene of the respiratory and central nervous system (with Professor Henderson); in immunology (with Professor Smith); in nutrition (with Professor Mendel); in problems of sanitary engineering (with Professor Barney); in problems relating to school and child hygiene (with Professor Gessel); and in vital statistics (with Dr. Dublin).

Both the Certificate in Public Health and the degree of Doctor of Philosophy are open to any college graduates, either men or women, provided they have pursued during their college course certain necessary prerequisites.

Beginning next autumn a new course of two years will be offered to medical graduates for which the degree of Doctor of Public Health will be conferred. It is believed that such a course, embodying not only class work but practical field work in a municipal health department, and the completion of study of a special problem designed to test and to develop the power of individual initiative, should furnish an ideal education for the public health administrator of the future.

BASE HOSPITAL NO. 21 OF THE WASHINGTON UNIVERSITY SCHOOL OF MEDICINE

ON April 20, 1919, Base Hospital No. 21, formed from the faculty of the Washington University school of medicine, St. Louis, landed in New York after 23 months service with the American Expeditionary Forces in France. The unit, in command of Major Fred T. Murphy, was in the first one thousand troops to go overseas; it was attached during the greater part of its service to the British forces and stationed at Rouen. Lieutenant Colonel Walter Fischel was in charge of the medical service. A part of the hospital, oper-

ating as Mobile Hospital No. 4 under the comand of Major W. B. Clopton, took part in the St. Mihiel and Argonne operations. Miss Julia Stimson, who went out as chief nurse, later became the head of the Nurses' Corps of the American Expeditionary Forces and has remained in France. Colonel Nathaniel Allison, orthopedic surgeon to the unit, was appointed orthopedic consultant of the American Expeditionary Forces. Major Sidney Schwab, neurologist, was transferred and placed in charge of Hospital No. 117 for war neuroses. Colonel Opie was detached from the unit to cooperate with Colonel Strong in the investigation of trench fever; he was afterwards placed in charge of the pneumonia commission in the Surgeon-General's Office. Colonel Murphy, after seven months service was appointed Medical and Surgical Director of the American Red Cross in France. He was succeed in command of the unit by Lieutenant Colonel Borden Veeder. The unit cared for over 62,000 patients during the eighteen months of its stay in Rouen.

THE CHEMICAL WARFARE SERVICE

The following letter has been sent by General Pershing to the chief of the Chemical Warfare Service:

American Expeditionary Forces
Office of the Commander-in-Chief
March 2, 1919

Colonel Edward N. Johnston,
Chief of Chemical Warfare Service,
American E. F., Tours.

My dear Colonel Johnston: Now that active operations have ceased and many of the personnel of the Chemical Welfare Service are returning to the United States, I desire to express to you and through you to all of your officers and enlisted men my appreciation of the valuable assistance they have rendered to the American Expeditionary Forces.

Upon our entry into the war we were faced with the problem of a new service in the organization of which the experience of our Allies was so new and so limited that there were few precedents to follow. The best brains and experience among students and teachers of chemistry were called into service, and by rapid establishment of gas schools and the aid of specially trained personnel, all combat troops were instructed in the necessary defensive measures against poisonous gas. The first gas regiment was trained and equipped, and rendered good service in the two American offensives of St. Mihiel and the Meuse-Argonne.

Due to the energetic cooperation of all ranks, much was accomplished in a very short time, for which it gives me great pleasure to extend to you all the thanks of your comrades of the American Expeditionary Forces. Will you convey this especially to Brigadier General Fries, whose enthusiasm and energy were such great factors in the successful organization and development of the service.

Sincerely yours,
John J. Pershing

THE DIVISION OF APPLIED PSYCHOLOGY OF THE CARNEGIE INSTITUTE OF TECHNOLOGY

Announcement is made of the following changes in the faculty of the division of applied psychology at the Carnegie Institute of Technology:

Lieutenant Colonel W. V. Bingham, executive secretary of the Committee on Classification of Personnel in the Army, returned to the Carnegie Institute of Technology on March first. He has been promoted to be dean of the division of applied psychology, which includes the departments of psychology, vocational education and personnel administration, and with which are affiliated the Bureau of Salesmanship Research and the Research Bureau for Retail Training.

Lieutenant Colonel Edward K. Strong, Jr., Ph.D. (Columbia), formerly professor of educational psychology at the George Peabody College for Teachers, has been appointed professor of vocational education and has already assumed his new duties as head of the department for the training of vocational teachers.

Major C. S. Yoakum, Ph.D. (Chicago), formerly director of the psychological laboratory at the University of Texas, has left the psychological section of the Surgeon General's Department to become associate professor of applied psychology.

Professor G. M. Whipple, who has been acting director of the Bureau of Salesmanship Re-

search during the absence of Colonel Walter Dill Scott on war service, has been released from these duties for work in educational research, through the return to Pittsburgh of Colonel Scott. At the close of the present academic year, however, Colonel Scott will devote himself to commercial practise as consultant on industrial personnel and will then give only a limited portion of his time to the Carnegie Institute of Technology.

Dr. Beardsley Ruml, who was on leave of absence with the War Department as head of the Trade Test Standardization Division of the Committee on Classification of Personnel, has resigned his position at Carnegie to enter commercial practise with the Scott Company.

SCIENTIFIC NOTES AND NEWS

A TESTIMONIAL dinner to Dr. N. L. Britton, director of the New York Botanical Garden, given by the managers at the Metropolitan Club on the evening of May 7, was attended by men of science from all parts of the country. Dr. D. T. MacDougal, director of the Desert Laboratory of the Carnegie Institution of Washington acted as toastmaster, and speeches reviewing the history of the organization of the garden by Dr. Britton twenty-three years ago, and of his widely inclusive and important researches were made by Dr. W. Gilman Thompson, president of the board; Professor R. A. Harper, chairman of the scientific directors; Professor H. F. Osborn, president of the American Museum of Natural History; Provost William H. Carpenter, of Columbia University; Dr. Arthur Hollick, director of the Staten Island Institute of Arts and Sciences, and Professor Geo. T. Moore, director of the Missouri Botanical Garden, at St. Louis. At the conclusion of the ceremonies Mr. Robert DeForest presented Dr. Britton with a loving cup appropriately inscribed on behalf of the board of managers. Congratulatory letters and telegrams from distinguished scientific men were read.

DR. THEODORE W. RICHARDS, professor of chemistry at Harvard University, has been elected president of the American Academy of Arts and Sciences.

PROFESSOR PAUL P. BOYD, dean of the college of arts and sciences at the University of Kentucky, has been elected president of the Kentucky Academy of Science.

REAR ADMIRAL JOHN E. PILLSBURY, U. S. N., has been elected president of the National Geographic Society.

THE John Fritz Medal of the four national societies of civil mining, mechanical and electrical engineering has been awarded to Major General George W. Goethals, for his achievement in the building of the Panama Canal. The presentation was made on May 22 by Ambrose Swasey, past president of the American Society of Mechanical Engineers. The speakers included W. L. Saunders, past president of the American Institute of Mining and Metallurgical Engineers; Henry L. Stimson, former secretary of war, and Colonel G. I. Fieberger, of West Point. Among those to whom the medal has been awarded in former years are: Lord Kelvin, for his work in cable telegraphy; Alexander Graham Bell, for the invention of the telephone; George Westinghouse, for the invention of the airbrake; Thomas A. Edison, for the invention of the duplex and quadruplex telegraph, and other devices, and Sir William H. White, for achievements in naval architecture.

DR. C. G. ABBOT, of the Astrophysical Observatory, Smithsonian Institution, sailed for South America on May 1, to inspect the Smithsonian solar constant observing station at Calama, Chile, and to observe the total solar eclipse at La Paz, Bolivia. He expects to return to Washington in August.

THE following members of the Princeton University faculty have returned from service abroad: Lieutenant Colonel Augustus Trowbridge (Engineers), professor of physics; Captain E. P. Adams, Royal Engineers, British Expeditionary Force, professor of mathematical physics, and Captain H. L. Cook, also of the Royal Engineers, assistant professor of physics.

Arthur H. Blanchard, consulting highway engineer, has been appointed chief of the Bureau of Public Works, Department of Citizenship, under the Army Overseas Educational Commission.

Major George F. Sever, Engineers, U. S. A., has been honorably discharged from the United States Army after a service of fifteen months and will make his headquarters in New York City for consulting engineer practise. Major Sever during his service made extensive and detailed investigations of the electric power conditions in New England as well as on the Pacific coast from Seattle to Los Angeles. His investigations covered analyses of the production of power by coal, oil and water, and the comparisons of these different methods.

Second Lieutenant Asa C. Chandler, Sanitary Corps, formerly assistant professor of zoology at Oregon Agricultural College, has undertaken parasitological work at the Central Medical Department Laboratory of the A. E. F. at Dijon, France.

Professor J. M. Aldrich, formerly professor of zoology in the University of Idaho, has been appointed associate curator of the Division of Insects in the National Museum, but more recently has been working with the Bureau of Entomology.

Dr. Hermann von Ihering, formerly director of the Museum of the State of São Paulo, Brazil, has been appointed director of the State Museum of Sta. Catharina, Brazil, to be organized by him at Flerianopolis (Estado de Santa Catharina, Brazil).

At its meeting held May 14, 1919, the Rumford Committee of the American Academy of Arts and Sciences voted the following appropriations: To Professor P. W. Bridgman, of Harvard University, in aid of his research on the effect of temperature and pressure on the physical properties of materials, particularly their thermal conductivity (additional to previous appropriation), $400; to Professor Horace L. Howes, of the New Hampshire College, in aid of his research on the experimental study of the effect of temperature on the luminescence and selective radiation of the rare earths, $500.

A new acoustical laboratory has just been completed at Riverbank, Geneva, Illinois. This laboratory was built for the late Professor Wallace C. Sabine, of Harvard University, by his friend, Colonel George Fabyan. In this laboratory Professor Sabine proposed to carry on the study of a number of problems in architectural acoustics requiring special building construction and entire freedom from extraneous noises. The building was constructed with the most careful attention to details, according to Professor Sabine's plans, and has many interesting structural features. It was just ready for occupancy at the time of his death. Colonel Fabyan, the founder of the laboratory, proposes to carry out, as far as possible, the original purpose for which the building and its equipment were intended. Dr. Paul E. Sabine has resigned his position as assistant professor of physics in the Case School of Applied Science to take charge of the research program which had been laid out.

An entomological expedition to South America is planned by Professor J. Chester Bradley, '06, of the college of agriculture of Cornell University. Leaving Ithaca next September, Professor Bradley will visit Brazil, Argentina and Chile; in the following spring he will be joined in Peru by Professors Cyrus R. Crosby and Dr. W. T. M. Forbes, of the agricultural college, and the party will work on the Amazon River as far as Peral near the headwaters. The expedition is conducted under the auspices of the university for the two-fold purpose of securing entomological specimens and of forming closer relations with South American institutions of learning.

Dr. S. M. Zeller, who has been special investigator in timber pathology for the Southern Pine Association, of New Orleans, La., with laboratory at the Missouri Botanical Garden, St. Louis, has been appointed investigator in fruit diseases at the Oregon Agricultural College, Corvallis, Oregon.

After being at work for one year, the technical personnel of the Bacteriological Insti-

tute of Buenos Aires, has been reappointed in a recent decree reorganizing the institution. The sections and the individuals in charge are: hygiene, Dr. Carbonnell; plague, Dr. Uriarte; serotherapy, Dr. Sordelli; physics and chemistry, Dr. Wernicke; experimental physiology and pathology, Dr. Houssay; medical zoology, Dr. Bachmann, and parasitology, Dr. Wolffhugel.

PROFESSOR I. NEWTON KUGELMASS, head of the department of chemistry at Howard College, addressed the Southern Child Health Association on "Applied Nutrition for Raising the Standard of Child Vitality in the Service of the Newer National Domism," in Birmingham, on May 1.

AT the London meeting of the Institute of Metals on May 19, Professor F. Soddy, F.R.S., delivered the ninth annual May lecture on "Radio-Activity."

PROFESSOR J. H. JEANS, F.R.S., delivered a lecture on "The Quantum Theory and New Theories of Atomic Structure" at a meeting of the Chemical Society in London on May 1.

DR. AARON AARONSON, agricultural expert, of Haifa, Palestine, was killed in a fall of an airplane on May 15, near Boulogne, while flying from London to Paris. Dr. Aaronsohn had been a technical adviser of the United States Department of Agriculture.

THE next annual meeting of the American Chemical Society will be held in Philadelphia, from September 2 to 6, inclusive. The Philadelphia section is already planning to continue the rising curve of success and attendance for the meeting next fall.

SURGEON-GENERAL IRELAND has authorized during the present "emergency," the preparation and application of psychological tests to recruits, that men of low mentality may be barred from the army.

THE thirty-fifth anniversary of the establishment of the Bureau of Animal Industry of the Department of Agriculture occurred on May 9. When the bureau began operations in 1884 it had a staff of less than twenty employees; it has now more than 5,200, working through thirteen divisions and offices.

HOMER P. RITTER, for many years an officer of the United States Coast and Geodetic Survey and a member of the Mississippi River Commission, died at Washington, D. C., April 21, 1919. He was returning from a meeting of the Mississippi River Commission at Memphis and was taken ill on the train. On his arrival at Washington, on Saturday morning, he was taken to the Emergency Hospital, and died there. Mr. Ritter was born in Cleveland, Ohio, March 4, 1855. He attended the high school in Cleveland from 1869 to 1873 and Columbia College School of Mines from 1878 to 1880. He was afterwards employed for several years on railway surveys. He entered the Coast and Geodetic Survey in 1865; was appointed an assistant in 1895, and continued in the service until the time of his death. Mr. Ritter had been employed on field work in all parts of the United States and in Alaska and his last duty was in charge of the Field Station of the Coast and Geodetic Survey, at Boston, Massachusetts.

PROFESSOR JOEL STEBBINS, secretary of the American Astronomical Society, writes: "In SCIENCE for May 10 there is an announcement that representatives of certain foreign observatories will be at the meeting of the American Astronomical Society at Ann Arbor on September 1. This is a mistake because so far as known to the officers of the society there will be no such representation from abroad." The erroneous statement was taken from the *Michigan Alumnus*.

UNIVERSITY AND EDUCATIONAL NEWS

THE seismological library of Count F. de Montessus de Ballore, director of the Seismological Service of Chile, has recently been purchased by Dr. J. C. Branner and presented to Stanford University. This is probably one of the most complete collections of seismological literature in existence and it is accompanied by a manuscript catalogue containing nearly 5,000 titles.

THE department of medicine of the University of Toronto is to be the recipient of a gift

of $25,000 a year for a period of twenty-five years from Sir John and Lady Eaton. This is to provide for a full-time clinician in the department of medicine and a half-time clinician in pediatrics.

The court of governors of the University College of North Wales, at their meeting at Bangor, appointed a deputation to wait upon the Board of Agriculture regarding the proposal to have only two schools of forestry in Great Britain—one in Scotland and the other either at Oxford or Cambridge. Fears were expressed that if this was carried into effect it would mean the extinction of the forestry department in connection with the University College of North Wales. It was felt that one of the two new schools should be established in Wales, with its large area of forests.

Sir Arthur Newsholme, K.C.B., who is now in the United States has accepted for the academic year 1919–1920, the chair of hygiene in the new school of public health of the Johns Hopkins Medical School.

Charles Joseph Tilden, professor of civil engineering at Johns Hopkins University, has been elected professor of engineering mechanics in Yale University and assigned to the Sheffield Scientific School.

Austin F. Rogers and Cyrus F. Tolman, Jr., of the department of geology at Stanford University, have been promoted from associate professors to professors.

Morris M. Leighton, Ph.D., Chicago, 1916, has accepted a joint-position as assistant professor of geology at the University of Illinois and as Geologist on the Illinois Geological Survey.

At the Massachusetts Institute of Technology the following assistant professors have been promoted to associate professorships: H. C. Bradley, department of drawing and descriptive geometry; C. E. Locke, department of mining engineering and metallurgy, and N. C. Page, department of electrical engineering. The following instructors have been appointed assistant professors: J. B. Babcock, 3d, railroad engineering; S. A. Breed, mechanical drawing and descriptive geometry; L. A. Hamilton, analytical chemistry; H. B. Luther, civil engineering; C. S. Robinson, industrial chemistry; R. H. Smith, mechanical engineering; C. E. Turner, biology and public health.

Mr. William Morris Jones, M.Sc., B.A., has been appointed lecturer and experimentalist in physics at the University College, Bangor.

DISCUSSION AND CORRESPONDENCE

QUANTITATIVE CHARACTER-MEASUREMENTS IN COLOR CROSSES

The writer, although working in plant and not in animal breeding, has been struck with the desirability of finding a more exact quantitative measure of degree of distribution of coat color in animal crosses. The following is suggested. Photograph the animal in a centered position on its two flanks. On the photographic prints of the right and left sides, determine the area of the color markings under investigation with a planimeter. These areas, reduced to percentages of the entire area photographed, will give a quantitative expression for the degree of extension of the character markings. The writer would venture to suggest the following possibility in the study of the operation of an extension factor. Let the photographic prints be ruled off in square centimeter areas with India ink. Then the relation of the color areas to the region of the animal's anatomy can be definitely established upon a quantitative basis. This having been done for the parents, the operation of an extension factor could be studied both quantitatively with respect to the amount of surface over which the factor became operative, and topographically with respect to the location and range of its operation in the progeny. If desired, it would be a comparatively simple matter to construct a cross-wire screen behind which the animal could be photographed, and which would thus reproduce the areas to scale directly.

In the study of inheritance in plants, the application of this method suggests itself very readily in color-inheritance in the seed-coats of beans and other legumes. By photograph-

ing the seeds with a photomicrographic apparatus, enlarging them a sufficient number of times, it is easy to bring the markings within the range of size where the use of the planimeter becomes a practical matter.

H. F. ROBERTS
KANSAS STATE AGRICULTURAL COLLEGE,
April 28

SURPLUS BISON FOR MUSEUMS

THERE is now a great surplus of male bison in the main Canadian herd at Buffalo Park, Wainright, Alberta. This is the largest herd of bison in the world, numbering 3,561 and is maintained by the Canadian government under the administration of the Dominion Parks Branch of the Department of the Interior.

Besides these 3,561 bison, there are also 8 at the Rocky Mountains Park, Banff, Alberta, and 182 at Elk Island Park, Lamont, Alberta. In 1909, there was a total of 685 bison at Buffalo Park, 118 were imported during 1910, 1911 and 1912 from the Pablo herd in Montana, and 10 bison cows from the Rocky Mountains Park during the winter of 1913–14. With the exception of these the increase has been due to natural causes.

It is said that elsewhere the percentage of male to female calves has been higher among bison in semi-captivity within enclosed parks than was the case when the herds freely roamed the plains. This has proved to be the case in the main Canadian herd, so that there is a great surplus of male bison that are not needed for herd purposes.

It is proposed to dispose of these surplus male bison for the nominal sum of $250 each to bonafide natural history museums of Canada and the United States, and further information can be obtained by such museums from Mr. J. B. Harkin, Commissioner of Dominion Parks, Department of the Interior, Ottawa, Ontario, Canada.

This should prove a splendid opportunity not only to secure skins for mounted specimens and groups, but also for museums to send their preparators to Buffalo Park to secure photographs, color sketches and accessories for habitat groups, and to secure skeletons, anatomical preparations of internal organs and parasites.

HARLAN I. SMITH
MUSEUM OF THE GEOLOGICAL SURVEY,
OTTAWA, CANADA

INFORMATION SERVICE FOR EXPERIMENTAL BIOLOGISTS

TO THE EDITOR OF SCIENCE: The Federation of American Societies for Experimental Biology, comprising the sciences of physiology, biological chemistry, pharmacology and experimental pathology, is now organizing an information service to serve as a medium of communication between persons seeking positions for teaching or research and institutions that wish to fill vacancies in these sciences. Persons, whether members of the federation or not, and institutions desiring to avail themselves of the service may communicate with Professor Edgar D. Brown, secretary of the executive committee of the federation, University of Minnesota, Minneapolis, Minn., and such information as is available will be supplied without cost to the applicant. Applicants are requested to supply the service with ten copies of their application, which should cover the following points:

1. *For the Person seeking a Position:* age; college and university training; degrees received; academic or other positions held; list of scientific papers published; membership in scientific societies; position and salary desired; copies of letters of recommendation; names and addresses of persons who can supply further information regarding the applicant; and any other information that the applicant desires to submit.

2. *For the Institution desiring to fill a Vacancy:* title of vacant position; date to be filled; requirements as to teaching or other routine work and research; salary to be paid; prospects of tenure of office and advancement; and any other information that the institution desires to submit.

The service does not undertake to recommend or to pass judgment upon applicants. It aims merely to serve as a clearing-house for such information as the above and to

bring into touch with one another candidates for positions and vacancies to be filled.

E. D. Brown,
University of Minnesota, *Secretary*

SCIENTIFIC BOOKS

The Mineral Deposits of South America. By Benjamin L. Miller, professor of geology, Lehigh University, and Joseph T. Singewald, associate professor of economic geology, Johns Hopkins University. New York, McGraw-Hill Book Company, Inc. 1919. Pp. 598, with 61 figs.

South America is a continent richly endowed with mineral resources: In Brazil are the largest high-grade iron-ore deposits in the world; at Chuquicamata, Chile, is the largest copper deposit in the world and the copper resources of Chile are second only to those of the United States; the nitrates of Chile constitute a world monopoly of that commodity; the tin lodes of Bolivia are by far the most productive in the world, their annual output being seven fold that of their nearest competitor; the world's greatest vanadium deposits are in Peru; and the only considerable source of platinum outside of Russia is in Colombia. The mineral deposits are not only of great importance commercially but are also of deep interest scientifically; and, as the present book by Professors Miller and Singewald shows, not more than a beginning has been made in solving the geologic problems they present.

The book under review, as we are told in the preface, is "the outcome of an extended trip through South America made by the authors in 1915." It is essentially a digest of available information on the mineral deposits of that continent, supplemented, however, by data the authors obtained during the visits, necessarily hasty, that they made to many of the mineral deposits of Brazil, Chile and Peru.

The opening chapter of the volume gives an outline of the geography, general geology and mineral resources of South America. It sketches also the history of the growth of the mineral industry, discusses the relation of mining to other industries, and outlines the probable trend of the future development. In view of the ground covered, the chapter, comprising thirty-two pages, is somewhat scant. It could be improved also by the addition of a series of outline maps of the continent showing quantitatively where the more important mineral commodities are produced, and by the insertion of statistical tables and diagrams showing the relation of South America's mineral output to that of the rest of the world. Such aids in giving the reader generalized views of the continent as a whole are conspicuously few in the present volume, but their urgent desirability should be considered by the authors when a new edition is planned. In places throughout the book there is an unnecessarily abundant use of local Latin-American terms, for most of which the authors could easily have substituted perfectly good English equivalents.

The remaining eleven chapters take up in alphabetical order the countries of South America. The description of the mineral resources of each is introduced by a summary of production. In places some statistical errors have crept in, as on page 77, where the outputs of lead, zinc and tin of Bolivia are given in terms of metal, whereas the figures cited are in reality those of ore or concentrate. Nor is it mentioned that the unit employed is the metric ton. These oversights are pointed out in passing, because current international statistics of mineral output are commonly vitiated by similar lapses. The summary of mineral production is followed by sketches of the topographic and geologic features of the country, of the distribution of the mineral deposits, and of the occurrence of the chief mineral resources. This general treatment is followed by more detailed descriptions of the important deposits and districts. Each chapter closes with a selected bibliography, the number of entries ranging up to 225 titles for the chapter on Chile. The entries are generally accompanied by brief synoptic characterizations. It is not always indicated that some Latin-American entries are merely translations of papers that appeared originally in French, German, American or other publications.

One of the notable sections of the volume

is the account of the Bolivian tin veins. Professors Miller and Singewald were fortunate in finding fossil plants in the shales at Potosi, and as a result of this discovery were able to establish that the tin veins at Potosi were formed in Pliocene or Pleistocene time. This is a remarkable conclusion and shows that these wonderfully productive tin lodes are in a geological sense extremely youthful; in fact they are probably the most youthful economically valuable mineral deposits of first rank in the world. Professors Miller and Singewald extend this age determination to all the Bolivian tin veins and maintain that they are all of Pliocene age. This conclusion may or may not be true, for the veins of the different districts appear to be associated with igneous rocks of a wide range of texture: pegmatites, aplites, granite, granite porphyry, rhyolite porphyry, rhyolite and "true quartz porphyry." As a matter of fact, no thorough field study of the Bolivian tin veins as a whole has yet been made. The studies hitherto made have been mainly petrographic, by geologists who have not collected the specimens they studied. It is not to be expected that a very deep insight into the fundamental problems could be attained by that method. Even in such a relatively subordinate matter as the nomenclature of the igneous rocks the petrologist has felt it necessary to use such obsolescent, non-committal terms as quartz porphyry to describe some of the rocks to which certain Bolivian tin veins are genetically related. When field work becomes the main method of attack and the microscope is used as an auxiliary—a powerful auxiliary it is true—more satisfactory results will be attained, and it is therefore a pleasure to learn that Professor Singewald is returning to Bolivia in order to take up a careful study of the tin veins in their broader geologic aspects.

Another district of special interest is Corocoro in Bolivia, which like the Lake Superior district is one of the world's two productive copper districts in which the chief ore mineral is native copper. Brazil holds the distinction of having in the Morro Velho mine the deepest mine in the world, the lowest workings having attained a vertical depth of 6,128 feet. The ore on the lower levels averages nearly $13 a ton in gold and indicates an extraordinarily long vertical range of gold-ore deposition. Apparently not much is known about the geology of this remarkable ore body, however. There are many other interesting deposits described in the book, but it would lengthen this review unduly even briefly to call individual attention to them. The outstanding feature of the economic geology of the South American continent is its preeminence in the number of its geologically youthful primary ore deposits of the first order of magnitude.

Professors Miller and Singewald have placed all interested in the mineral resources of South America under a deep debt for the labor they have expended in marshalling the widely scattered information and for presenting it attractively in a condensed and easily usable form. They can be gratefully assured that they have filled a genuine want in the literature of economic geology.

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THE ECOLOGY OF NORTH AMERICAN LYMNÆIDÆ

IN a recent paper in SCIENCE[1] the following statement appears: "There are three groups of limnæas found in North America, the abysmal limnæas including *Lymnæa* (*Acella*) *haldemani* Binney, the moss limnæas including *Lymnæa* (*Galba*) *truncatula* Müll., *humilis* Say, and the marsh limnæas including *Lymnæa stagnalis, L. columella,*" etc. This classification of our pond snails is so unusual and so far from representing the true ecological relations of this group, as well as of the allied groups *Planorbis* and *Physa,* that a few observations on the subject seem necessary.

As far as known there are no abysmal lymnæas or other fresh-water pulmonates in America, comparable to the true abysmal fauna of the deep lakes in Switzerland, where *Lymnæa stagnalis* occurs in Lake Geneva at a depth of 250 meters and *Lymnæa abyssicola*

[1] SCIENCE, N. S., XLVIII., p. 578, 1918.

in Lac Leman at depths of 25 to 250 meters.[2] In the Swedish lake Vätter, mollusks, including lymnæas have been dredged from depths down to 120 meters.[3] In America no such depths have yielded mollusks in our fresh-water lakes, the deepest water from which lymnæas have been found being in Lake Michigan where several species were obtained at High Island Harbor at a depth of 10 meters.[4] It is possible that some of the deep western lakes, as Lake Pend d'Orielle, Idaho, examined by the writer some time ago, may contain a deep-water fauna.

The species cited as an example of abysmal lymnæas, *Acella haldemani* (Desh.) Binney, is really a shallow-water, swamp-loving species, when adult, in the fall, living at or near the surface attached to vegetation in water less than five feet deep. In summer (July) the young may be found in water not exceeding six feet deep, among such plants as *Potamogeton*.[5]

The present center of distribution of American lymnæas is the Canadian faunal region, where upwards of 50 species and races live. North and south and east and west of this area there is a more or less rapid decrease in number of species. It is in this area that we find the greatest variation in the ecological relations of the group. This is due in part to the effect on the topography made by the great ice sheet which swept over the territory during the Pleistocene Period, and left upon its retreat the largest number of ponds and small lakes known in any part of the world. As typical pond and lake animals, the lymnæas have reacted favorably to this profusion of small bodies of water and a large and varied fauna has resulted. This is also true of other groups of fresh-water mollusks especially the related fresh-water pulmonates, *Planorbis* and *Physa*.[6] Ecologically, our lymnæid fauna may be divided into about five types:

1. *The open shore lake type,* where the environment is an open shore of a lake exposed to the full force of the winds and waves. Here such lymnæas as *Lymnæa stagnalis lillianæ* Baker, *Galba catascopium* Say, *G. emarginata* Say, and *G. nasoni* Baker are common and typical of such a habitat.

2. *The quiet bay or pond type,* where the environment is protected from the force of the waves and wind by barriers of one kind or another. The water is shallow and there is usually an abundance of vegetation, such as *Scirpus, Potamogeton, Castalia, Nymphæa, Typha* and filamentous algæ which provide much of the food of these snails. Such species as *Acella haldemani* (Desh.) Binn., *Pseudosuccinea columella* (Say), *Bulimnea megasoma* (Say), and *Lymnæa stagnalis* Linné are typical of such a habitat.

3. *The marsh type,* where the water is shallow, seldom more than three or four feet deep, and where there is an abundance of swamp vegetation such as *Typha, Pontederia, Decodon* and a few *Nymphæa*. The bottom is usually of mud or accumulated vegetable débris. Such species as *Galba palustris* (Müll.), *G. obrussa* (Say), *G. reflexa* (Say), and *G. elodes* (Say) are characteristic of this kind of a habitat.

4. *The mud-flat type.* This type of habitat may border a swamp, pond or river, where the water is quiet and where an area of wet mud is left just above the water line. Here small species of the subgenus *Simpsonia* are at home and we find such species as *Galba parva* (Lea), *G. dalli* (Baker), *G. umbilicata* (Adams), and some of the small varieties of *G. obrussa* (Say) living by thousands, simulating the marine Littorinas in their ecological relations.

5. *The intermittent pool or stream.* This is a type of habitat found in all parts of the

[2] Forel, *Bull. Soc. Vaudoise des Sci. Nat.*, X., p. 217; XIII., p. 1 (1869, 1874).

[3] *Internationale Revue der gesamten Hydrobiologie und Hydrographie,* Band 7, Heft 2–3, pp. 146–204, 1915.

[4] Walker, *Nautilus,* IX., pp. 3–5, 1895.

[5] For the life history and ecology of this species see Baker, *Nautilus,* XXX., pp. 135–138; Tech. Pub. No. 9, N. Y. State College of Forestry at Syracuse University, 1918.

[6] Baker, "Monograph Lymn. N. A.," pp. 52–67, 1911.

United States, but especially common in the west and southwest, in the more arid parts of the country, where water stands for but a small part of the year and where the lymnæas, and other mollusks must be able to withstand the period of drouth by hibernating in cracks in the bottom of the pond or stream. Such species as *Galba caperata* (Say), *G. cubensis* (Pfr.), and *G. bulimoides* and its varieties are typical of these habitats. *Galba palustris* and some other species normally living in marshes may at times be compelled to adopt this hibernating type of habitat during unusual periods of drought.

The writer has not found lymnæas as a rule inhabiting moss, although the little amphibious species (*parva, dalli,* etc.) may do so in some places and have, indeed, been collected from such a habitat. All lymnæas as well as other fresh water mollusks, whether in lake or marsh habitats, prefer a location where there is a quantity of vegetation and where there is an abundance of filamentous algæ (*Cladophora, Œdogonium,* etc.) upon which they largely feed, in some cases to such an extent as to give a green color to the shell. The relation of algæ to molluscan and other life has recently been rather fully stated by the writer.[7]

It is interesting to note that fresh-water mollusks, the lymnæas in particular, respond quickly to changes in environment, a species characteristic of a marsh adapting itself to a rough lake shore habitat if compelled to make the change. Thus typical *stagnalis* is characteristic of quiet, pond-like bodies of water, while the variety *lillianæ* lives on a shore exposed to the full force of the waves. The change in habitat has resulted in a larger aperture and foot in *lillianæ* the better to resist the moving power of the waves. In Oneida Lake, a large colony of *Galba palustris* was forced by a change in the environment, caused by the barge canal construction, to change from a shallow swampy habitat to that of an open rocky shore exposed to violent wave action. The effect of this change has been to produce a shell with a wide, flaring aperture and a larger foot area, a direct response to the environment which demands a larger foot area for resisting the waves.[8] The lymnæas are not, as generally supposed, mollusks chiefly of ponds and ditches, as might be thought from reading the paper in SCIENCE, but also of the larger inland lakes, in fact a greater variety is found in the lakes than in any other kind of habitat.

The fossil lymnæas, as well as other fresh-water fossil groups, are in need of careful revision in the light of modern work on the existing species. As the shell in a measure reflects the internal structure, this revision ought not to be difficult with ample material of fairly well-preserved specimens. The twenty-five or more species described appear to represent the larger groups recognized among the recent forms. Several of these species, as mentioned by Hannibal, are problematic and may belong to other groups, but more perfect material is needed for this purpose. Some confusion of species has occurred in figuring and describing a few of these lymnæas, attention to which has already been directed by the writer.[9]

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[7] Tech. Pub., No. 9, N. Y. State College of Forestry, Syracuse University, 1918.

[8] Baker, Tech. Pub. No. 9, N. Y. State College of Forestry, p. 180.

[9] "Mon. Lymn. N. Am.," pp. 89, 95, 96.

SPECIAL ARTICLES

SOUND AND FLASH RANGING[1]

THE location, by means of sound, of active enemy batteries and the direction of the fire of the friendly artillery on these and other enemy objectives is new; has been successfully practised by the Allies and has been clumsily practised by the Germans. The location and ranging by visual observation (flash ranging) is an outgrowth of standard artillery methods and differs from these chiefly in the extent of front covered by a single group of observers and by the adoption of certain electrical devices and

[1] Abstract of paper presented before the American Philosophical Society, April 26, 1919.

methods of observation designed to avoid confusion in operation on a very active front. The Germans had an extremely efficient flash ranging service, many of the good features of which were copied by the Allies as they became known through captured documents. The flash ranging reported not only the positions and activity of hostile batteries, but also the exact locations of other enemy objectives such as traffic on roads, troop movements, position of observation balloons, etc. Being provided with high-power telescopes, and since observation was obtained from stations on a wide base (from five to eight miles) the flash ranging sections were particularly well suited for observation and ranging in the enemy back areas, and these sections rendered invaluable services both to the artillery and to the army intelligence.

A battalion of five companies (74th Engineers) furnished the ranging troops for an American army. A sound ranging section was in the field with the first American division to enter the line (March, 1918) and on the signing of the armistice the entire front of the second American army was covered with both flash and sound ranging sections and a portion of that of the first American army was covered by flash ranging, although the ranging battalion allotted to this army had not yet arrived in France. The ranging service was thus a "going concern" from the very first and was not one of the many which could have delivered results had the war but lasted a little longer.

A flash ranging section consisted of about one hundred men commanded by a lieutenant who was assisted by three other officers and by an exceptionally high grade of non-commissioned officers and men, all of whom had been given a month's intensive training in France. The instruments and methods employed were those suited for accurate survey and present no special features of interest.

A sound ranging section was similar in organization to the flash section except that there were fewer enlisted men (60–70) due to the fact that instruments took the place of living observers to a great extent. The "central" instrument recorded photographically the time of arrival of the sound of the enemy guns at a series of instruments at surveyed positions near the front line and covering a length of about five miles; this instrument delivered automatically developed and fixed photographic records in less than a minute after the sound of the enemy gun reached the front line and this record could be interpreted by the use of quick graphical methods so that the position of the enemy gun could be telephoned to the friendly artillery in about a minute more. The probable accuracy of the location could be given and also the caliber and target of the piece which had just fired. The service was not interfered with by rain or fog or darkness, though it was rendered less accurate by strong winds. Calculations were rendered difficult by great artillery activity though not impossible except under actual "barrage" conditions.

In ranging the friendly artillery on enemy objectives it was possible to range all the guns of the battery simultaneously, thus effecting considerable time saving over other methods of ranging. If the ranging was being done on an enemy battery which had just fired the accuracy attained was very great (less than twenty-five yards), because of the fact that in this case no wind or temperature corrections need be applied in the calculations.

After the American advances of September and November a careful survey was made of most of the enemy positions which had been located by either the sound or the flash ranging sections on a part of the American front; the result of this survey was that of the locations of the flash ranging about one third were accurate to within fifty yards, another third to within one hundred yards and the other third with errors of more than one hundred yards. In the first third were many extremely accurate locations of guns the positions of which were visible from two or more observation posts; in the last third were mostly locations of concealed heavy caliber distant guns generally more easily located by sound ranging, whose positions could only be inferred from smoke puffs by day or flares in the sky by night.

The survey showed that the estimates of accuracy made by the sound rangers in report-

ing a location had been very conservative; a location reported not accurate to within fifty yards was often accurate to within twenty-five yards. In general, the average of a half dozen locations of the same gun taken on different days under differing weather conditions was of a very high order of accuracy; often a matter of but five or ten yards.

In general a location either by sound or by flash which had been rated "fair" when reported to the artillery was found on survey to have been within the unavoidable errors in artillery fire.

An idea may be gained of the amount of artillery information supplied by the ranging sections from the following figures taken from the reports of the artillery information officer of one of the American corps. This officer had at the time the following sources of information: three American sound ranging sections, two American and three French flash ranging sections, aviation and observation balloons. During a period of three weeks of rapid advance when the sound sections were out of operation while moving for a considerable portion of the time 425 separate locations of enemy batteries were made. Of these the two American flash sections reported 64 per cent. the three French flash sections reported 16 per cent. and the three American sound sections reported 21 per cent. In a period of two weeks when the advance had been checked by the Germans the total number of locations were 392, and the percentages were: From the three American flash sections 38 per cent.; from the two French flash sections 8 per cent., and from the three American sound sections 56 per cent.

The following figures taken from another and very active sector are also instructive. For a period of three days preparation for an advance the following locations were made: Sound, 22; flash, 22; balloons, 0; aviation, 0. For a period of sixteen days of rapid advance: Sound, 4; flash, 46; balloons, 30; aviation 77. For a period of four days of stabilization: Sound, 6; flash, 34; balloons, 13; aviation, 15. These figures are characteristic. During preparations for an advance, both the sound and flash sections are very useful and important sources of information. During rapid advance the sound ranging does not get into action as often or as soon as the flash. In this period the greater part of the information comes from the air observation.

Both sound and flash ranging have proved their value in the American Expeditionary Forces and are to be retained in the peace-time army; the sound because it is the one source of information when all others fail in foggy weather and because thus far no camouflage has been devised to prevent its working; the flash because of its relatively great mobility and consequent importance in open warfare.

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THE AMERICAN MATHEMATICAL SOCIETY

THE two hundred and third regular meeting of the society was held at Columbia University on Saturday, April 26, extending through the usual morning and afternoon sessions. This being the first eastern meeting since October, the attendance was large, including sixty-seven members, indicating, as it may be hoped, a revival of the conditions preceding the war.

President Morley occupied the chair, being relieved by Professor Kasner. The election of the following persons to membership in the society was announced: Mr. N. W. Akimoff, Philadelphia, Pa.; Dr. Tobias Dantzig, Columbia University; Mr. A. C. Maddox, Guthrie, Okla., High School; Mr. Montford Morrison, Chicago, Ill.; Professor Ganesh Prasad, Central Hindu College, Benares, India; Mr. F. M. Weida, State University of Iowa; Mr. C. L. E. Wolfe, University of California. Two applications for membership were received.

It was decided to hold the coming summer meeting of the society at the University of Michigan in the first week in September. Professors Beman, Bliss, Karpinski, Osgood and the secretary were appointed a committee on arrangements for this meeting. A committee was also provided to prepare nominations for officers to be elected at the annual meeting in December.

Professor E. W. Brown, L. E. Dickson and H. S. White were appointed as representatives of the society in the division of physical sciences of the national research council; and President R. S.

Woodward, and Professors Birkhoff and MacMillan as representatives of the society in the American section of the International Astronomical Union.

The committee on the publication of a mathematical year book presented a preliminary report and was continued and asked to make a further report at a future meeting.

A special feature of the meeting was the reports by Captain Jackson, Dr. Gronwall and Major Veblen on the work in ballistics at Aberdeen and Washington, which occupied the first part of the afternoon session. The titles of these reports are included in the list of papers below.

About fifty members and friends gathered at the midday luncheon; thirty-two attended the dinner at the Faculty Club in the evening. Much satisfaction was expressed at the revival of these pleasant occasions.

The Chicago Section held its regular spring meeting on March 28–29. The San Francisco Section met at the University of California on April 5.

The following papers were read at the New York meeting:

C. J. Keyser: "Concerning groups of dyadic relations in an arbitrary field."

J. K. Whittemore: "Certain functional equations connected with minimal surfaces."

W. B. Fite: "Linear functional differential equations."

L. B. Robinson: "Note on a theorem due to Wilczynski."

L. B. Robinson: "A curious system of polynomials, continued."

O. E. Glenn: "Covariants of binary modular groups."

O. E. Glenn: "Modular covariant theory of the binary quartic. Tables" (preliminary report).

O. E. Glenn: "Invariants of velocity and acceleration."

F. H. Safford: "Reduction of the elliptic element to the Weierstrass form."

Philip Franklin: "Computation of the complex roots of the function $P(z)$."

A. R. Schweitzer: "On the history of functional equations" (preliminary report).

E. D. Roe, Jr.: "The irreducible factors of $1 + x + \cdots + x^{n-1}$. Second paper."

E. D. Roe, Jr.: "The irreducible factors of a circulant."

Dunham Jackson: "Small arc computations and related questions."

T. H. Gronwall: "Qualitative properties of the ballistic trajectory."

Oswald Veblen: "Progress in design of artillery projectiles."

G. D. Birkhoff: "Boundary value and expansion problem for differential systems of the first order."

G. D. Birkhoff: "Note on the closed curves described by a particle moving on a surface in a gravitational field."

G. D. Birkhoff: "Note on the problem of three bodies."

Edward Kasner: "A characteristic property of central forces."

J. F. Ritt: "On weighting factor curves for low elevations."

A. C. Lunn: "Some functional equations in the theory of relativity."

J. R. Kline: "Concerning sense on closed curves in non-metrical plane analysis situs."

R. L. Moore: "On the most general class L of Fréchet in which the Heine-Borel-Lebesgue theorem holds true."

H. S. Vandiver: "On the class number of the field $\Omega(e^{2i\pi/p^m})$ and the second case of Fermat's last theorem."

F. W. Beal: "On certain points of congruences of circles."

L. L. Silverman: "Regular transformations of divergent series and integrals."

T. C. Fry: "The application of the modern theories of integration to the solution of differential equations."

C. A. Fischer: "Completely continuous transformations and Stieltjes integral equations."

Arnold Emch: "On closed curves described by a spherical pendulum."

H. S. White: "An explicit formula for two old problems."

L. P. Eisenhart: "Triply conjugate systems with equal point invariants."

F. N. Cole,
Secretary

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